REMARKS

The application has been amended and is believed to be in condition for allowance.

Claims 1-34 were examined.

There are no outstanding formal matters.

Amendments

Claims 1 and 21 are amended. No new matter is entered by way of these amendments.

Claims 1 and 21 of the present application defines a device which encodes two different images, namely a diffracted image and a polarized image. The amended independent claims require that the anisotropic material has an orientation with the optical axis/axes lying substantially parallel to the encoding surface, and that orientations of the optical axes are fixed.

The amended claim sets out the essential innovative structural features that provide these two images, as follows:

- An encoding surface has a micro-relief pattern over at least part thereof, the micro-relief pattern having a predetermined spatial distribution to produce a predetermined diffracted first image when illuminated in use.
- An optically anisotropic layer of liquid crystal material is located over the encoding surface.

- The anisotropic material has an orientation with the optical axis lying substantially parallel to the encoding surface.
- At least part of the micro-relief pattern induces local orientation of the optical axis of the anisotropic layer so that the local optical axis of the liquid crystal material is aligned at respective orientations corresponding to the predetermined spatial distribution of the micro-relief pattern.
- The alignment of the local optical axes in respective orientations defines a polarization modulation (in the anisotropic material) so that a polarized second image is produced.
- The orientations of the optical axis in the anisotropic layer are fixed.
- Overall, the device operates so that both a diffracted image and a polarized image are viewable which both vary spatially across at least part of the overall image.

Rejections Under 35 USC 102, 103

Claims 1, 2, 5, 8, 10, 12, 13, 15-18, 20-23, 33 and 34 were rejected under section 102 as anticipated by KNOP 4,251,137.

Claims 3, 4, 14, 19, and 24-32 were rejected under section 103 as obvious in further view of SUZUSHI 2002/0110651.

Claims 6 and 7 were rejected under section 103 as obvious in further view of NIKOLOV 2004/0095637.

Claim 9 was rejected under section 103 as obvious in further view of the Admitted Prior Art.

Claim 11 was rejected under section 103 as obvious over KNOP alone.

Claims 1 and 21 are novel and non-obvious

KNOP does not anticipate as KNOP does not teach all the recited features. KNOP does not render obvious the claimed invention as KNOP, alone or in combination with the other references, do not suggest the recited invention.

KNOP does disclose a tuneable diffractive-subtractive filter that is a development of an earlier prior-art filter. The basic prior-art filter provided techniques which make it possible to derive zero-diffraction order light of a specified colour hue using a predetermined waveform surface relief pattern (a unidirectional grating).

The invention of KNOP is to make such a diffractive-subtractive filter tuneable. This objective is achieved by immersing the relief pattern in "… an adjustable index-of-refraction optically transparent fluid medium." This proposed filter has "…control means for selectively controlling the index of refraction of the fluid medium." The medium must therefore be such that it allows the index of refraction to be dynamically varied.

The teachings of KNOP must be understood in this context.

In the embodiments of Figures 3a and 3b and Figure 4, the fluid medium is a “twisted nematic” liquid crystal material (col.2, line 49), and the index of refraction is altered by applying an electric field to cause the molecules to align themselves from the usual twisted orientation to a vertical orientation. No other types of liquid crystal are hinted at or referred to at all and the devices in KNOP would not work with crystal material other then twisted nematic. The operation of the devices of KNOP are similar to those of a standard liquid crystal display as shown in http://en.wikipedia.org/wiki/Twisted_nematic_field_effect.

Note particularly that in KNOP, the operation depends on application of an electrical field to impart a dynamic change to the orientation of the molecules. Without the ability to effect this change the device of KNOP would not be tuneable, which is the clear principal function of the filter. Note also that the device of KNOP actually loses its optical anisotropy/birefringence when the electric field is applied (see col.3, lines 23 to 25).

Differences between the claimed invention and KNOP

KNOP does not teach or make obvious a device which provides a polarized image and a diffracted image from the same relief structure.

There is no disclosure whatsoever in KNOP of a polarized image. The intrinsic nature of 'twisted nematic' configuration is fixed by two orthogonal unidirectional alignment surfaces on the inner sides of the top and bottom substrates sandwiching the LC material. Any polarization modulation (even if it were intended, which is not the case) can only be imparted by the application of electric field which orients the LC molecules in the vertical direction and is not determined by the directionality of the underlying structure as is required of the device claimed in Claim 1.

In KNOP the liquid crystal material does not have a "…planar orientation with the optical axis lying substantially parallel to the encoding surface." In the invention locally any (x, y) point has the same direction through the thickness of the layer. In a twisted nematic configuration the optical axis varies through the thickness of the layer. There is never a change of optical axis in the plane and the direction of the optical axis is changed (in the vertical direction only) by an application of the electrical field and not by the local orientation of the micro-relief structure in the plane.

Another fundamental difference already alluded to is that the local orientations of the optical axis in the liquid crystal material of the invention are permanently fixed. To fix the liquid crystal material of KNOP would be counter to commonsense and would result in a filter that used expensive

liquid crystal material for no apparent reason without utilizing any of the properties it possesses over a standard optical transmission medium and which no longer fulfilled the main objective of being tuneable.

For similar reasons it would not be obvious to combine KNOP with Suzushi as suggested by the Official Action because this would simply render the KNOP device non-tuneable and destroy the operative objective of KNOP.

The Official Action's suggestion that the skilled person would include the fixing process "for the purpose of allowing rapid analysis of the encoded surface and to minimize potential analysis error." does not make sense. As best as can be understood, the Official Action is hypothesising applications clearly not envisaged by KNOP or supported by the record as being practical. Further, even if this modification were done there would be no polarization modulation as required by Claim 1.

Moreover, the KNOP gratings are unidirectional and have to be so to provide the uniform output required of a filter. In the present invention the grating (micro-relief pattern) can have any suitable spatial distribution as required to provide an image which varies spatially across its field.

Thus, to summarize, in the claimed invention the optical axis of the molecules (long axis) is always in the plane. The directions in this plane are determined by the directions of the micro relief structures in the plane. The microrelief

structures determined the orientation not only of the molecules at the interface with the encoding surface but also of the remaining molecules in the thickness of the all the molecular layers above. The molecules are always in the x-y plane and all the changes (encoding) are in this plane throughout the thickness of the layer. The direction of the microrelief determines the direction of the optical axis and the thickness determines the value of the retardation.

There are no changes in the vertical direction except the thickness of the layer. If one looks at Figures 3a and 3b of KNOP, the molecules are aligned in the plane in 3a (in only one direction) but in 3b they are switched to be vertical to the plane by the effect of the electric field. Indeed KNOP talks about and describes a 'twisted nematic' configuration where the optical axis twists inside the layer. There is never a change of optical axis in the plane, hence the direction of the optical axis is changed (in the vertical direction only) by the application of the electric field and not by the local orientation of the micro relief structure in the plane.

To encode anything the axis is changed (in the vertical direction only) by the application of the electric field and not by the local orientation of the micro relief structure in the plane. It is clear that nowhere in KNOP is there a mention of a 'polarized image', but even if the Official Action wants to argue that such an image is obtained anyway, the variations are not

determined by the spatial distribution of the micro-relief structure. If he wants to obtain any effect on the polarization he has to apply electric field, and furthermore for any local differences there needs to be different electrodes for different regions and apply different electric fields, hence have something similar to an LCD display (as KNOP indeed indicates).

Hence, even if there is any information in this image it is not determined by the spatial distribution but by electrical pulses. Further, there is no link between the diffracted image and whatever polarized image he can claim to have, because one is determined by the spatial pattern and the other by an electric field.

In the invention, the same spatial distributions determine the diffracted image and the polarized image. These requirements impose crucial structural differences. In KNOP's device the liquid crystal material must be in a fluid form and sandwiched between two substrates with conducting electrodes on their internal sides. In the claimed invention, the liquid crystal material is polymerized and fixed and the polarized image is obtained through the local modulations on a single substrate, hence no need for electric field. Claims 17 and 22 have been amended to recite this more specifically. NO new matter is entered by way of these amendments.

Furthermore, in 3a with planar alignment the liquid crystal is anisotropic but in 3b with the vertical alignment the

liquid crystal is isotropic (it is clearly mentioned in lines 10-25, column 3). In the claimed invention's case, the liquid crystal is always anisotropic, only the direction of the optical axis locally changes in the plane in line with the directions of the structure. The invention does not change the refractive index, only the direction of the optical axis is changed in the plane.

For all these reasons, the claims are clearly both novel and non-obvious. The claims not discussed are patentable at least for depending from a patentable claim.

Reconsideration and allowance of all the claims are respectfully requested.

Should there be any matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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